

performing data staging at predetermined time intervals; and  
updating the calling profile cube by generating a snapshot cube from a call table; and  
merging the snapshot cube with the calling profile cube to generate an updated calling profile cube.

af 24. The method of claim 28 wherein the calling profile cube has a cell that includes a probability distribution value based on one of the probability distribution on calls to each callee and the probability distribution on all calls.

25. The method of claim 22 wherein the dimensions include a day-of-week hierarchy, a time hierarchy, and a duration hierarchy.

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Please add the following new claims:

sub B 27. (New) A method for detecting telecommunication fraud performed in a data processing system having a data warehouse and an OLAP server, the method comprising:

retrieving a plurality of call records from the data warehouse;

as- generating a calling profile cube based on the call records; wherein the calling profile cube includes information on multiple customers;

retrieving records from the profile table and based thereon generating a profile cube representing the records from the profile table, said profile cube having predetermined dimensions that are the same as the dimensions of the snapshot cube; merging the snapshot cube and the profile cube to generate an updated profile cube; and deriving the volume-based calling pattern cubes based on the updated profile cube.

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3. A method as in claim 27 wherein the step of when the volume-based calling pattern cube is in a first predetermined relationship with predetermined fraudulent volume-based calling pattern, performing a first action includes one of:

flagging a particular caller with the volume-based calling pattern being analyzed as suspicious; automatically generating an alert that specifies callers with suspicious volume-based calling pattern; performing further investigation on callers with suspicious volume-based calling pattern; cancellation of telephone services for callers with suspicious volume-based calling pattern; and performing other appropriate remedial actions.

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4. A method as in claim 1 further comprising:  
analyzing the calling pattern cube by utilizing at  
least one OLAP operation.

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6. A method as in claim 27 wherein the predetermined  
fraudulent volume-based calling pattern in one of a  
personalized calling pattern and a group-based pattern.

7. A method as in claim 2 further comprising:  
storing the updated profile cube into the profile  
table in the data warehouse; and  
performing data staging between the profile table and  
the updated profile cube at predetermined time  
intervals.

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8. A method as in claim 2 wherein said profile cube,  
snapshot cube, and updated profile cube each includes  
at least two dimensions and at least two levels.
9. A method as in claim 8 further comprising:  
analyzing the calling pattern cube by utilizing at  
least one OLAP operation along more than one  
level.
10. A method as in claim 8 further comprising:  
analyzing the calling pattern cube by utilizing at  
least one OLAP operation along more than one  
dimension.

11. A method as in claim 2 wherein the profile cube, snapshot cube, and the updated profile cube each are multi-level and multi-dimensional cubes.

12. A method as in claim 2 wherein the profile table and the call table each has a plurality of attributes, and the profile cube and snapshot cube each has a plurality of dimensions, said attributes corresponding in a one-to-one fashion to the dimensions.

13. A method as in claim 2 wherein the profile cube includes at least one cell having probability based values.

14. A data processing system comprising:  
a data warehouse for storing data in a relational format, said data warehouse including a profile table and a call table;  
an OLAP server, coupled to the data warehouse, for providing predetermined OLAP operations; and  
a profile engine, coupled to the data warehouse for computing, maintaining and utilizing caller pattern cubes that represent caller profiles; wherein the caller pattern cubes can be utilized to detect telecommunication fraud.

15. A data processing system as in claim 14 further comprising:

a fraud detection module for detecting telecommunication fraud by comparing known fraudulent profiles to caller pattern cubes; the profile engine further generating a profile cube from information selected from the profile table, generating a snapshot cube, updating the profile cube by merging the profile cube and the snapshot cube to generate an updated profile cube, and deriving a calling pattern cube based on the updated profile cube; wherein the profile engine is a scalable computation engine that is implemented by OLAP programming supported by the OLAP server.

16. A data processing system as in claim 14 further comprising:

an analysis tool for use by a data analyst to perform one of comparing the calling pattern cube to known fraudulent calling pattern cube and extracting information from the calling pattern cube based on selected dimensions, levels, and ad-hoc queries provided by the data analyst.

17. A data processing system as in claim 14 further comprising:

a visualization tool for use by a data analyst to display the calling pattern cube in different formats, levels, and dimensions.

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18. A data processing system as in claim 14 further comprising:

a data staging tool for transferring data between the profile cube stored in the OLAP server and profile table in the data warehouse at predetermined time intervals.

20. A method as in claim 1 further comprising:

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utilizing an OLAP server to create a calling profile cube, updated calling profile cubes, derive calling pattern cubes from the calling profile cube, analyzing calling pattern cubes, and comparing calling pattern cubes;

wherein OLAP programming supported by the OLAP server provides a scalable computation engine for generating and processing the calling pattern cubes.

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22. The method of claim 28 wherein the calling profile cube is a multi-dimensional and a multi-level cube and wherein the volume-based calling pattern cubes are multi-dimensional and a multi-level cubes.

23. The method of claim 28 further comprising:

generating a volume-based calling pattern cube for each individual customer based on the multi-customer calling profile cube;  
comparing the volume-based calling pattern cube for each customer to a predetermined fraudulent volume-based calling pattern; and  
when the volume-based calling pattern cube is in a first predetermined relationship with predetermined fraudulent volume-based calling pattern, performing a first action.

28. (New) A method for detecting telecommunication fraud performed in a data processing system having a data warehouse and an OLAP server, the method comprising:

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retrieving a plurality of call records from the data warehouse;  
generating a calling profile cube based on the call records; wherein the calling profile cube includes information on multiple customers;  
generating a volume-based calling pattern cube for each individual customer based on the multi-customer calling profile cube;  
generating a probability-based calling pattern cube based on the volume-based calling pattern cube for each individual customer;  
comparing the probability-based calling pattern cube for each customer to a predetermined fraudulent probability-based calling pattern;

when the probability-based calling pattern cube is in a first predetermined relationship with predetermined fraudulent probability-based calling pattern, performing a first action.

29. A method as in claim 28 wherein the step of when the probability-based calling pattern cube is in a first predetermined relationship with predetermined fraudulent probability-based calling pattern, performing a first action includes one of:

flagging a particular caller with the probability-based calling pattern being analyzed as suspicious;

as automatically generating an alert that specifies callers with suspicious probability-based calling pattern;

performing further investigation on callers with suspicious probability-based calling pattern;

cancellation of telephone services for callers with suspicious probability-based calling pattern;  
and

performing other appropriate remedial actions.

30. (New) The method of claim 29 wherein the probability-based calling patterns enables one of the analysis and comparison of a first probability-based calling patterns that covers a first time period with a